006_sd_project

2023-08-28

(1) Calculate σ with spreadsheet of population with equally-probable outcomes.

The goal is to find the population standard deviation (σ) of a 20-sided die.

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

where x_i represents the ith equally-likely outcome in the population with N possibilities.

1. In A1, write `1`
2. In A2, write `=A1+1`, and drag down to fill A1:A20
3. In A22, write `n`
4. In A23, write `=count(A1:A20)`
5. In A25, write `mu`
6. In A26, write `=sum(A1:A20)/A23`
7. In B1, write `=(A1-A$26)^2`, and drag down to fill B1:B20
8. In D2, write `pop variance`
9. In D3, write `=sum(B1:B20)/A23`
10. In D5, write `pop sd`
11. In D6, write `=sqrt(D3)`

(2) Calculate s with spreadsheet

The goal is to generate 10 measurements of the standard normal random variable (Z) and calculate the Bessel-corrected sample standard deviation (s) using a spreadsheet.

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

where x_i represents the ith element of the sample with n measurements.

1. Make a new tab named `samsd`
2. In A1, write `"x"`
3. Generate a column of 10 measurements of Z using `=norminv(rand(),0,1)` in A2:A11
4. In A13, write `"xbar"`
5. In A14, use `=average(A2:A11)` to calculate the sample mean
6. In A16, write `"n"`
7. In A17, write `=count(A2:A11)`
8. In B1, write `"x-xbar"`
9. In B2, write `=A2-A$14`, and drag the formula down for B2:B11
10. In C1, write `"(x-xbar)^2"`

11. In C2, write `=B2^2`, and drag the formula down for C2:C11
12. In C13, write `"sample variance"`
13. In C14, write `=sum(C2:C11)/(A17-1)`
14. In C16, write `"sample standard deviation"`
15. In C17, write `=sqrt(C14)`
16. In C18, write `=stdev(A2:A11)`

Now, go back to the first tab, where we calculated the population standard deviation.

1. In D7, write `stdevp(A1:A20)`.

(3) Calculate σ from a discrete probability distribution

$$\sigma = \sqrt{\sum_{i=1}^{N} p_i(x_i - \mu)^2}$$

where $\mu = \sum_{i=1}^{N} p_i x_i$ and N is the number of possibilities.

1. Open a third tab, named `popsd2`
2. In A1, type `x`
3. In A2, type `31`
4. In A3, type `32`
5. In A4, type `33`
6. In A5, type `34`
7. In B1, type `p`
8. In B2, type `0.4`
9. In B3, type `0.2`
10. In B4, type `0.3`
11. In B5, type `0.1`
12. In C1, type `x*p`
13. In C2, type `=A2*B2` and drag to fill C2:C5
14. In C7, type `mu`
15. In C8, type `=sum(C2:C5)`
16. In D1, type `p*(x-mu)^2`
17. In D2, type `=B2*(A2-C$8)^2` and drag to fill D2:D5
18. In D7, type `sigma^2`
19. In D8, type `=sum(D2:D5)`
20. In D10, type `sigma`
21. In D11, type `=sqrt(D8)`

(4) Submit your spreadsheet!

On canvas, submit the spreadsheet.